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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/538,534
Filing Date: June 10, 2005
Appellant(s): FRASCH ET AL.

____
Richard L. Catania, Esq.
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed May 13, 2009 appealing from the Office action mailed July 11, 2008.

(1) Real Party in Interest

A statement identifying by name the real party of interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(**8) Evidence Relied Upon**

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

<u>A. Claims 40-45 and 47-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 1/2002) as evidenced by Mock (Nano Letters Pub 4/2002) and in further view of Pettingell et al (US Patent 6449088 Filed 1993).</u>

Regarding Claims 40-45 Yasuda teaches a method of detecting motion in nanoscale structures. Yasuda teaches providing a molecular structure having a rotating arm, wherein the molecular structure is an F1-ATPase enzyme (Abstract). Yasuda further teaches attaching a nanoparticle (i.e. a 40 nm bead) to the rotating arm of the molecular structure so that the nanoparticle rotates with the rotating arm of the molecular structure (See Fig 1). Yasuda further teaches that bead rotation was imaged by laser dark field microscopy and only light scattered by the bead was detected (Page 898 and Fig 1). Thus Yasuda teaches a step of exposing a light to the nanoparticle wherein the nanoparticle scatters light. Further Yasuda teaches that it was desirable to observe rotational motion of F1-ATPase in order to investigate the magnitudes, speeds, and timings of the substeps that make up a full rotation (page 898).

Yasuda does not teach a method wherein the nanoparticle has a first surface and a second surface wherein the first surface has greater area than the second surface. Yasuda does not teach that the first surface of the nanoparticle scatters a first polarized wavelength of the light when the nanoparticle is in a first position and the second

surface of the nanoparticle scatters a second polarized wavelength of light when the nanoparticle is in a second position. Further Yasuda does not teach a method wherein the nanoparticle is a gold nanorod. Additionally Yasuda does not teach a method wherein the first polarized wavelength of light is longer than the second polarized wavelength of light. Finally Yasuda does not teach a method wherein the first polarized wavelength of light is red light and the second polarized wavelength of the light is green light.

However Sonnichsen teaches methods that use gold nanoparticles that are in the shape of rods. The rods have diameters of b= 15-25 nm along the two short axes and lengths of up to a= 100 nm (page 2, col 1). Thus Sonnichsen teaches a nanoparticle that has a first and second surface wherein one surface has a greater area that the other surface. Sonnichsen teaches that the long axis resonance can examined by using excitation light polarized along the long axis and that the short axis resonance spectra can be examined by using excitation light polarized along the short axis (page 2, col 2). As evidenced by Mock it is a property of the nanorod that when light is polarized along the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3). Specifically Figure 3e shows color images of a silver/gold/nickel coded nanowire, illuminated with light polarized along the long axis. The gold portion gives off red light when illuminated with light polarized along the long axis. Figure 3f is the same silver/gold/nickel coded nanowire as in 3e, but it is illuminated with light polarized along

the short axis. The gold portion gives off green light when illuminated with light polarized along the short axis. As such it is a property of nanorods that they have a first surface that scatters a first polarized wavelength of light when the nanorod is in a first position relative to the light source (i.e., when the light is polarized along the long axis) and a second surface that scatters a second polarized wavelength of light when the nanorod is in a second position relative to the light source (i.e., when the light is polarized along the short axis).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda by using a gold nanorod as suggested by Sonnichsen. In the instant case, it is advantageous to use gold nanorods to observe a rotational motion because gold nanorods have two different surfaces. As evidenced by Mock it is a property of the nanorod that when light is polarized along the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3). Thus rotational motion can be detected by observing alternating flashes of red and green light. Additionally Sonnichsen teaches that they found a drastic reduction of the plasmon dephasing rate in nanorods as compared to nanospheres and that nanorods compared to nanospheres showed much weaker radiation damping. These findings result in relatively high light scattering efficiencies and large local field enhancement factors, making nanorods interesting for a range of optical applications (page 4, col 2). Further the claimed invention would have been obvious because the substitution of a

nanosphere for a nanorod would have yielded predictable results (i.e., the ability to observe alternating first and second wavelengths of light as the nanorods move from one position to the next position) to one of ordinary skill in the art at the time of the invention.

Additionally it is noted that the combined teachings of Yasuda and Sonnichsen do not teach a step of filtering the first and second wavelengths of light through a polarizing filter.

However Pettingell discloses using polarizing microscopes which use polarizers to look at anisotropic materials (nanorods are anisotropic because they have a first and second axis) (Column 3, lines 10-15). The polarizing filters are used to separate the first and second wavelengths of light generated by anisotropic materials.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda and Sonnichsen by using the polarizer of Pettingell. Polarizers were well known in the art at the time of the invention for looking at anisotropic materials as demonstrated by Pettingell. Thus after the substitution of a non anisotropic material (i.e., the nanobead of Yasuda) for an anisotropic material (i.e., the nanorod of Sonnichsen) it would have been obvious to one of skill in the art at the time of the invention to look at other observation techniques available particularly ones that were used for looking at anisotropic materials since nanorods are anisotropic. Further all of the claimed elements were known in the prior art and one skilled in the art could have combined the elements, and the combination

would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

Regarding Claims 47-52 Yasuda teaches a method of detecting motion in nanoscale structures. Yasuda teaches attaching a nanoparticle (i.e. a 40 nm bead) to the rotating arm of an F1-ATPase enzyme so that the nanoparticle rotates with the rotating arm of the F1-ATPase enzyme (See Fig 1). Yasuda further teaches that bead rotation was imaged by laser dark field microscopy and only light scattered by the bead was detected (Page 898 and Fig 1). Thus Yasuda teaches a step of exposing a light to the nanoparticle wherein the nanoparticle scatters light. Further Yasuda teaches that it was desirable to observe rotational motion of F1-ATPase in order to investigate the magnitudes, speeds, and timings of the substeps that make up a full rotation (page 898).

Yasuda does not teach a method wherein the nanoparticle has a first surface and a second surface wherein the first surface has greater area than the second surface. Yasuda does not teach exposing light to a first surface of the nanoparticle to scatter a first polarized wavelength of the light and exposing light to a second surface of the nanoparticle to scatter a second polarized wavelength of light. Further Yasuda does not teach a method wherein the nanoparticle is a gold nanorod. Additionally Yasuda does not teach a method wherein the first polarized wavelength of light is longer than the second polarized wavelength of light.

However Sonnichsen teaches methods that use gold nanoparticles that are in the shape of rods. The rods have diameters of b= 15-25 nm along the two short axes and

lengths of up to a= 100 nm (page 2, col 1). Thus Sonnichsen teaches a nanoparticle that has a first and second surface wherein one surface has a greater area that the other surface. Sonnichsen teaches that the long axis resonance can examined by using excitation light polarized along the long axis and that the short axis resonance spectra can be examined by using excitation light polarized along the short axis (page 2, col 2). As evidenced by Mock it is a property of the nanorod that when light is polarized along the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3). Specifically Figure 3e shows color images of a silver/gold/nickel coded nanowire, illuminated with light polarized along the long axis. The gold portion gives off red light when illuminated with light polarized along the long axis. Figure 3f is the same silver/gold/nickel coded nanowire as in 3e, but it is illuminated with light polarized along the short axis. The gold portion gives off green light when illuminated with light polarized along the short axis. As such it is a property of nanorods that they have a first surface that scatters a first polarized wavelength of light when the nanorod is in a first position relative to the light source (i.e., when the light is polarized along the long axis) and a second surface that scatters a second polarized wavelength of light when the nanorod is in a second position relative to the light source (i.e., when the light is polarized along the short axis).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda by using a gold

nanorod as suggested by Sonnichsen. In the instant case, it is advantageous to use gold nanorods to observe a rotational motion because gold nanorods have two different surfaces. As evidenced by Mock it is a property of the nanorod that when light is polarized along the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3). Thus rotational motion can be detected by observing alternating flashes of red and green light. Additionally Sonnichsen teaches that they found a drastic reduction of the plasmon dephasing rate in nanorods as compared to nanospheres and that nanorods compared to nanospheres showed much weaker radiation damping. These findings result in relatively high light scattering efficiencies and large local field enhancement factors, making nanorods interesting for a range of optical applications (page 4, col 2). Further the claimed invention would have been obvious because the substitution of a nanosphere for a nanorod would have yielded predictable results (i.e., the ability to observe alternating first and second wavelengths of light as the nanorods move from one position to the next position) to one of ordinary skill in the art at the time of the invention.

Additionally it is noted that the combined teachings of Yasuda and Sonnichsen do not teach a step of filtering the first and second wavelengths of light through a polarizing filter.

However Pettingell discloses using polarizing microscopes which use polarizers to look at anisotropic materials (nanorods are anisotropic because they have a first and

second axis) (Column 3, lines 10-15). The polarizing filters are used to separate the first and second wavelengths of light generated by anisotropic materials.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda and Sonnichsen by using the polarizer of Pettingell. Polarizers were well known in the art at the time of the invention for looking at anisotropic materials as demonstrated by Pettingell. Thus after the substitution of a non anisotropic material (i.e., the nanobead of Yasuda) for an anisotropic material (i.e., the nanorod of Sonnichsen) it would have been obvious to one of skill in the art at the time of the invention to look at other observation techniques available particularly ones that were used for looking at anisotropic materials since nanorods are anisotropic. Further all of the claimed elements were known in the prior art and one skilled in the art could have combined the elements, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

B. Claims 54-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 1/2002) as evidenced by Mock (Nano Letters Pub 4/2002).

Regarding Claims 54-59 Yasuda teaches a method of detecting motion. Yasuda teaches attaching a nanoparticle (i.e. a 40 nm bead) to the rotating arm of an F1-ATPase enzyme so that the nanoparticle rotates with the rotating arm of the F1-ATPase enzyme (See Fig 1). Thus Yasuda teaches attaching a nanoparticle to a rotating portion (rotating arm) of a base structure (the F1-ATPase). Yasuda further teaches that

bead rotation was imaged by laser dark field microscopy and only light scattered by the bead was detected (Page 898 and Fig 1). Thus Yasuda teaches a step of exposing a light to the nanoparticle wherein the nanoparticle scatters light. Further Yasuda teaches that it was desirable to observe rotational motion of F1-ATPase in order to investigate the magnitudes, speeds, and timings of the substeps that make up a full rotation (page 898).

Yasuda does not teach a method wherein an anisotropic nanoparticle is used. Yasuda does not teach exposing light to the anisotropic nanoparticle to scatter first polarized and second polarized wavelengths of the light. Further Yasuda does not teach a method wherein the anisotropic nanoparticle is a gold nanorod. Yasuda does not teach that the anisotropic nanoparticle has a first surface and a second surface wherein the first surface has greater area than the second surface. Additionally Yasuda does not teach a method wherein the first polarized wavelength of light is longer than the second polarized wavelength of light.

However Sonnichsen teaches methods that use gold nanoparticles that are in the shape of rods. The rods have diameters of b= 15-25 nm along the two short axes and lengths of up to a= 100 nm (page 2, col 1). Thus Sonnichsen teaches a nanoparticle that has a first and second surface wherein one surface has a greater area that the other surface. Sonnichsen teaches that the long axis resonance can examined by using excitation light polarized along the long axis and that the short axis resonance spectra can be examined by using excitation light polarized along the short axis (page 2, col 2). As evidenced by Mock it is a property of the nanorod that when light is polarized along

the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3). Specifically Figure 3e shows color images of a silver/gold/nickel coded nanowire, illuminated with light polarized along the long axis. The gold portion gives off red light when illuminated with light polarized along the long axis. Figure 3f is the same silver/gold/nickel coded nanowire as in 3e, but it is illuminated with light polarized along the short axis. The gold portion gives off green light when illuminated with light polarized along the short axis. As such it is a property of nanorods that they have a first surface that scatters a first polarized wavelength of light when the nanorod is in a first position relative to the light source (i.e., when the light is polarized along the long axis) and a second surface that scatters a second polarized wavelength of light when the nanorod is in a second position relative to the light source (i.e., when the light is polarized along the short axis).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda by using a gold nanorod as suggested by Sonnichsen. In the instant case, it is advantageous to use gold nanorods to observe a rotational motion because gold nanorods have two different surfaces. As evidenced by Mock it is a property of the nanorod that when light is polarized along the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3).

Thus rotational motion can be detecting by observing alternating flashes of red and green light. Additionally Sonnichsen teaches that they found a drastic reduction of the plasmon dephasing rate in nanorods as compared to nanospheres and that nanorods compared to nanospheres showed much weaker radiation damping. These findings result in relatively high light scattering efficiencies and large local field enhancement factors, making nanorods interesting for a range of optical applications (page 4, col 2). Further the claimed invention would have been obvious because the substitution of a nanosphere for a nanorod would have yielded predictable results (i.e., the ability to observe alternating first and second wavelengths of light as the nanorods move from one position to the next position) to one of ordinary skill in the art at the time of the invention.

C. Claims 46 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda et al (Nature 2001) in view of Sonnichsen (Physical Review Letter Pub 1/2002), as evidenced by Mock (Nano Letters Pub 4/2002), and Pettingell et al (US Patent 6449088 Filed 1993) as applied to claims 40 and 47 above and in further view of Felder (US Patent 6232066).

The teachings of Yasuda, Sonnichsen, Mock, and Pettingell are presented above.

As discussed above Yasuda teaches a method comprising attaching a nanoparticle (i.e. a 40 nm bead) to the rotating arm of an F1-ATPase so that the nanoparticle rotates with the rotating arm of the F1-ATPase (See Fig 1). As shown in Figure 1 the bead was attached to the F1-ATPase through streptavidin/biotin binding.

The combined references do not teach a method which further includes a step of disposing a detection DNA strand between the nanoparticle and the molecular structure, wherein the detection DNA strand hybridizes with a target DNA strand, if the target DNA strand matches the detection DNA strand, to form a structural link between the molecular structure and the nanoparticle.

However Felder teaches a method for DNA detection. Felder teaches a method wherein a linker oligonucleotide is attached to anchor (col 1 line 66 to col 2 line 3). Felder teaches that the anchor can be a protein (col 7, line 7) and in the instant case the F1-ATPase is being interpreted as the anchor since it is a protein. Felder further teaches that the linker oligonucleotide contains a sequence that is specific for the target to be detected (col 1 line 66 to col 2 line 3). Felder teaches that if the target is present a portion of the target will hybridize to the linker oligonucleotide and another portion of the target will hybridize to a detection oligonucleotide comprising a label (col 1 line 66 to col 2 line 3). Thus Felder teaches a method wherein the linker oligonucleotide, the target oligonucleotide, and the detection oligonucleotide form a structural link between the anchor and the label.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method of Yasuda, Sonnichsen, Mock, and Pettingell by using a linker oligonucleotide, a target oligonucleotide, and a detection oligonucleotide to attach the nanoparticle (i.e., the label) to the F1-ATPase (i.e., the anchor) as suggested by Felder. One of skill in the art would have been motivated to use a linker oligonucleotide, a target oligonucleotide, and a detection

oligonucleotide to attach the nanoparticle (i.e., the label) to the F1-ATPase (i.e., the anchor) rather than streptavidin/biotin binding for the benefit of being able to detect hybridization. This modification allows one to detect hybridization because if the target is present the nanoparticle (i.e., label) would be attached to F1-ATPase (i.e., anchor) and rotation of the nanoparticle could be observed and would indicate the presence of the target. On the other hand if the target was not present the nanoparticle (i.e., label) would not attach to the F1-ATPase (i.e., anchor) and rotation of the nanoparticle could not be observed and would indicate the absence of the target.

(10) Response to Argument

A. Rejection of claims 40-45 and 47-52 under 35 U.S.C. 103(a) as being unpatentable over Yasuda in view of Sonnichsen as evidenced by Mock and in further view of Pettingell.

In the brief (page 6), the Appellants begin by summarizing the teachings in the primary reference. Yasuda explores the rotation of F1-ATPase, which acts as a rotary motor. Yasuda attaches a 40nm gold bead to a unit of the F1-ATPase, and then captures images of the rotation using a high speed CCD camera (see pages 898-899 and Fig 1). Appellants point out that the method of Yasuda requires a bead of sufficiently small size so as to not impede rotation, yet large enough to give an optical signal (see Fig 1b). The Appellants further note that Yasuda detects rotation by using a laser to illuminate the rotating gold bead under dark field microscopy. The light scattered by the gold bead as it turns is photographed by a fast frame CCD camera (See Fig 1).

In the brief (page 7) the Appellants discuss how the method of Yasuda is different from the present invention. For example instead of using a gold bead the present invention uses a nanoparticle that has a first and second surface, wherein the first surface is of greater area than the second. Appellants state that since this type of nanoparticle is anisotropic an entirely different approach can be used for detecting motion. Appellants state that in the present invention the nanoparticle scatters polarized light at first and second wavelengths which correspond to the first and second surfaces as they rotate. When detected through a polarizing filter, the motion is observed as a flashing, or blinking of different colors of light, e.g. red and green. The Appellants further noted that these differences are recognized by the rejection of record and that Sonnichsen as evidenced by Mock and Pettingell have been cited by the Examiner to cure the deficiencies of Yasuda.

In the brief (pages 7-8) the Appellants also summarize the teachings of Sonnichsen. The Appellants state that Sonnichsen is directed to plasmon damping of gold nanoparticles, and specifically discusses nanobeads and nanorods. Sonnichsen teaches that plasmon damping is of particular concern in surface-enhanced Raman scattering (SERS), which requires the dephasing of the particle plasmon to be slow. Sonnichsen reports that the dephasing rate for nanorods is reduced as compared to nanospheres and concludes that the rods would be superior to spheres in "optical applications where large local field enhancements are required, such as SERS" (see pages 77402-1 and 77402-4).

In the brief (pages 8-9) the Appellants argue that Sonnichsen in non-analogous art because the reference is not directed to rotational motion or the detection of rotational motion. Appellants argue that although Sonnichsen teaches that rods would be superior to spheres in “optical applications” the optical applications that Sonnichsen is referring to are not applications for detecting rotation. Appellants assert that there is no assessment of rotational behavior of any kind, let alone polarized scattering and corresponding differential wavelength detection. Further they state that there is no suggestion of these properties in Sonnichsen. For these reasons Sonnichsen is believed by Appellants to be non analogous art.

This analysis has been fully considered but is not persuasive. In response to Appellants’ argument that Sonnichsen is nonanalogous art, it has been held that a prior art reference must either be in the field of appellant’s endeavor or, if not, then be reasonably pertinent to the particular problem with which the Appellant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In the instant case Sonnichsen and the instant invention are both drawn to methods which use nanoparticles therefore Sonnichsen is considered to be analogous art.

Further it is emphasized that this is a 103 rejection and that Sonnichsen is only being relied upon to teach some of the missing elements in Yasuda. Specifically Sonnichsen is being relied upon for teaching the following elements that are missing in Yasuda: (i) a nanoparticle that has a first surface and a second surface wherein the first surface has greater area than the second surface, (ii) the nanoparticle has a first

surface that scatters a first polarized wavelength of the light when the nanoparticle is in a first position and a second surface that scatters a second polarized wavelength of light when the nanoparticle is in a second position, (iii) a nanoparticle that is a gold nanorod, (iv) a method wherein the first polarized wavelength of light is longer than the second polarized wavelength of light, and (v) a method wherein the first polarized wavelength of light is red light and the second polarized wavelength of the light is green light. In the instant case Sonnichsen teaches methods that use gold nanoparticles that are in the shape of rods. The rods have diameters of b= 15-25 nm along the two short axes and lengths of up to a= 100 nm (page 2, col 1). Thus Sonnichsen teaches a nanoparticle that has a first and second surface wherein one surface has a greater area that the other surface. Sonnichsen teaches that the long axis resonance can examined by using excitation light polarized along the long axis and that the short axis resonance spectra can be examined by using excitation light polarized along the short axis (page 2, col 2). As evidenced by Mock it is a property of the nanorod that when light is polarized along the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3). Specifically Figure 3e shows color images of a silver/gold/nickel coded nanowire, illuminated with light polarized along the long axis. The gold portion gives off red light when illuminated with light polarized along the long axis. Figure 3f is the same silver/gold/nickel coded nanowire as in 3e, but it is illuminated with light polarized along the short axis. The gold portion gives off green light when illuminated with light

polarized along the short axis. As such it is a property of nanorods that they have a first surface that scatters a first polarized wavelength of light when the nanorod is in a first position relative to the light source (i.e., when the light is polarized along the long axis) and a second surface that scatters a second polarized wavelength of light when the nanorod is in a second position relative to the light source (i.e., when the light is polarized along the short axis). As such the optical properties of nanorods were known in the art at the time of the invention.

Further it is noted that Yasuda is directed to detecting rotational motion by exposing light to a nanoparticle that is attached to a molecular structure having a rotating arm (page 898 and Fig 1). Therefore the fact that Sonnichsen does not teach detecting rotational motion is irrelevant because this is taught in the primary reference.

In the brief (pages 9-10) the Appellants state that even if Sonnichsen was analogous art the result of combining Yasuda and Sonnichsen would not lead to the claimed invention. The Appellants discuss how Yasuda was worried about having a particle that was large enough to scatter enough light to create an image that can be captured, but small enough so as to not impede rotation. The Appellants point out that Sonnichsen observed that the rods appear as bright in the microscopic measurement as spheres of much larger volume (page 077402-4, col 1). The Appellants assert that based on this teaching in Sonnichsen one would reasonably and objectively conclude that the nanorods of Sonnichsen could be used in the method of Yasuda for the reasons expressed in Sonnichsen.

In the brief (pages 10-11) the Appellants argue that even if the nanorods of Sonnichsen were used there would be no reason to change the observation technique of Yasuda so as to take advantage of anisotropic scattering and detection using polarized filtering that attends gold nanorods under the conditions of the invention. Appellants refer to the Final Rejection where the Examiners says that the excitation light in Sonnichsen is polarized and concludes that the scattered light is polarized and can therefore be detected as claimed. Appellants assert that this statement is gleaned from their own specification and that they find no such disclosure in Sonnichsen. Additionally Appellants claims that the Examiner has used improper hindsight in forming the rejection.

In the instant case this analysis has been fully considered but is not persuasive. While it may not have been necessary to alter the detection technique of Yasuda, after the substitution of a non anisotropic material (i.e., the nanobead of Yasuda) for an anisotropic material (i.e., the nanorod of Sonnichsen) it would have been obvious to one of skill in the art at the time of the invention to look at other observation techniques available particularly ones that were used for looking at anisotropic materials since nanorods are anisotropic.

It is noted for the record that a third reference (Pettingell) is being relied upon to teach the step of filtering the first and second wavelengths of light through a polarizing filter. Specifically Pettingell discloses using polarizing microscopes which use polarizers to look at anisotropic materials (nanorods are anisotropic because they have a first and second axis) (Column 3, lines 10-15). The polarizing filters are used to separate the

first and second wavelengths of light generated by anisotropic materials. Since Pettingell teaches that polarizers were well known in the art at the time of the invention for looking at anisotropic materials it would be obvious to one of skill in the art to modify the method of Yasuda and Sonnichsen by using a polarizing microscope to observe rotational movement of an anisotropic material such as a nanorod. Thus motivation is present and has been provided.

Further in response to Appellant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the appellant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). In the instant case the rejection only takes in account was known in the art about nanorods at the time the invention made. As evidenced by Mock it is a property of the nanorod that when light is polarized along the long axis of a gold nanorod it produces red light (which has a wavelength of about 650 nm) and when light is polarized along the short axis of the gold nanowire it produces green light (which has a wavelength of about 510 nm) (See Fig 3). Specifically Figure 3e shows color images of a silver/gold/nickel coded nanowire, illuminated with light polarized along the long axis. The gold portion gives off red light when illuminated with light polarized along the long axis. Figure 3f is the same silver/gold/nickel coded nanowire as in 3e, but it is

illuminated with light polarized along the short axis. The gold portion gives off green light when illuminated with light polarized along the short axis. Thus one of skill in the art would have recognized that rotational motion of a nanorod could be detected by observing alternating flashes of red and green light. As such the optical properties of nanorods were known in the art at the time of the invention.

In the brief (pages 11-12) the Appellants state Mock investigates plasmon resonance of nanowires and is cited for the purpose of showing various polarization properties of nanoparticles. Appellants state that the combination of Yasuda and Sonnichsen does not need the specific polarization properties taught by Mock in order to operate and create its CCD image. Appellants further state that Mock corroborates the hindsight evaluation that has been used and that no one would ever think to look at polarization and Mock. Pettingell is even farther removed, and deals with the details of polarizing filters and the like.

In the instant case this analysis has been fully considered but is not persuasive. As discussed above while it may not have been necessary to alter the detection technique of Yasuda it would have been obvious to one of skill in the art at the time of the invention to look at other observation techniques available particularly ones that were used for looking at anisotropic materials since nanorods are anisotropic. The statement by Appellants that no one would ever think to look at polarization and Mock is misleading particularly since Mock is directed to an experimental study of polarization dependent scattering of light (see abstract). Pettingell is relevant because the reference discloses using polarizing microscopes which use polarizers to look at anisotropic

materials (e.g., materials that have a first and second axis) (Column 3, lines 10-15). The polarizing filters are used to separate the first and second wavelengths of light generated by anisotropic materials. Since Pettingell teaches that polarizers were well known in the art at the time of the invention for looking at anisotropic materials it would be obvious to one of skill in the art to modify the method of Yasuda and Sonnichsen by using a polarizing microscope to observe rotational movement of a nanorod.

B. Rejection of claims 54-59 under 35 U.S.C. 103(a) as being unpatentable over Yasuda in view of Sonnichsen as evidenced by Mock.

In the brief (page 12) Appellants state that they have fully addressed the combination Yasuda and Sonnichsen as evidenced by Mock in their arguments pertaining to claims 40-45 and 47-52.

Appellant's arguments regarding the combination of Yasuda and Sonnichsen as evidenced by Mock have been fully addressed above in the response pertaining to claims 40-45 and 47-52. The response to Appellants arguments, as set forth above, applies equally to the present grounds of rejection.

C. Rejection of claims 46 and 53 under 35 U.S.C. 103(a) as being unpatentable over Yasuda in view of Sonnichsen as evidenced by Mock and Pettingell and in further view of Felder.

In the brief (page 13) Appellants state that they have fully addressed the combination of Yasuda, Sonnichsen as evidenced by Mock, and Pettingell in their

arguments pertaining to claims 40-45 and 47-52. Appellants further state that Felder is relied upon for its teaching of anchors and linkers. The reference does not bring the principal combination of Yasuda and Sonnichsen any closer to the claimed invention.

Appellant's arguments regarding the combination of Yasuda, Sonnichsen as evidenced by Mock, and Pettingell have been fully addressed above in the response pertaining to claims 40-45 and 47-52. The response to Appellants arguments, as set forth above, applies equally to the present grounds of rejection. Further it is noted that Felder is only being relied upon for teaching a method that includes a step of disposing a detection DNA strand between the nanoparticle and the molecular structure wherein the detection DNA strand hybridizes with a target DNA strand, if the target DNA strand matches the detection DNA strand, to form a structural link between the molecular structure and the nanoparticle. The combination of Yasuda, Sonnichsen as evidenced by Mock, and Pettingell teach all of the other claimed elements for the reasons set forth above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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